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Social and cultural determinants of oral cholera vaccine uptake in Zanzibar

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Conflicts of interest

The authors declare that no conflicts of interest exist.

Key words

Vaccine acceptance; vaccine uptake; oral cholera vaccine; social and cultural determinants; endemic cholera; Zanzibar

Running title

Determinants of cholera vaccine uptake in Zanzibar

Abbreviations/acronyms

WHO: World Health Organization; OCV: Oral Cholera Vaccine; EMIC: Explanatory Model

Interview Catalogue; AICc: Akaike Information Criterion, corrected

Abstract

Effectiveness of mass cholera vaccination campaigns requires not only technical and financial capacity but also consideration of social and cultural factors affecting vaccine acceptance.

This study examined the influence of local community views of cholera on oral cholera vaccine (OCV) uptake in a mass vaccination campaign in 2009 in peri-urban and rural areas of Zanzibar. It used data from interviews conducted before the campaign and followed previous research assessing determinants of anticipated OCV acceptance. OCV uptake was lower than the reported anticipated acceptance. Less than half of the 356 adult respondents (49.7%) drank the required two doses of OCV. Variables referring to socio-cultural features of diarrheal illness that respondents identified with a cholera case vignette explained uptake better than analysis only of socio-demographic characteristics. Somatic features of illness not specific for cholera were negative determinants. Recognition of unconsciousness as a serious sign of dehydration and concern that cholera outbreaks would overwhelm the local healthcare system in the rural area were positive determinants of acceptance. Female gender, rural residence and older age were also positive determinants of OCV uptake. For further vaccine action with OCVs, cholera as a cause of severe dehydration should be distinguished from other causes of diarrhea. Planning should acknowledge rural concern about the relationship of limited capacity of the healthcare system to cope with cholera outbreaks and the priority of a cholera vaccine. Findings recommend particular efforts to increase cholera immunization coverage among young adults, in peri-urban areas and for men.

Introduction

In 2009, 45 countries mainly from Africa and Asia reported a global total of 221,226 cases and 4,946 deaths attributable to cholera.¹ Recognizing difficulties with limited surveillance and under-reporting, the World Health Organization (WHO) estimates annual morbidity and mortality to be in excess of 3 million cases and 100,000 deaths.²

Besides timely rehydration and administration of antibiotics to patients who suffer from acute watery diarrhea caused by *Vibrio cholerae* O1 or O139, cholera control also involves preventive activities that center on the provision of safe water in sufficient quantities, sanitation and health education (WASH). Using oral cholera vaccines (OCV) has also been recommended to supplement WASH in an integrated strategy to reduce the public health burden of cholera in affected countries.³ In endemic settings, community-based mass vaccination campaigns in selected high-risk areas have been the preferred route for efficient deployment of OCV.

Following research examining key epidemiological parameters and characteristics of available OCVs in different populations and contexts,⁴⁻⁷ studies have investigated the practical feasibility and economic aspects of using OCVs in vulnerable populations that are at risk of recurrent cholera outbreaks.⁸⁻¹³ Effective use of OCVs for maximum impact on morbidity and mortality depends on a variety of factors: in addition to the availability of a safe and efficacious vaccine and a well-functioning health system with sufficient capacity to implement mass immunizations, local views of potential respondents about cholera, and how these affect whether or not they would accept a vaccine, have to be considered for maximum coverage, but have often been neglected.¹⁴

Recently published studies addressing the relationship between local perceptions of severe

enteric diarrheal illness and willingness or desire to receive vaccines have mainly focused on shigellosis and typhoid fever.¹⁵⁻²¹ Studies on cholera have assessed social factors of vaccine acceptance²² or have considered policymakers' views,²³ but empirical study of cultural factors of cholera and how they affect OCV uptake is lacking.

Research reported in this paper took advantage of a mass vaccination campaign that was conducted in cholera-endemic areas of peri-urban and rural Zanzibar in 2009. Approximately 50,000 inhabitants were targeted for vaccination with Dukoral®, which was the only OCV pre-qualified by the WHO at that time. This two-dose vaccine was offered without charge in two rounds in January and February 2009.²⁴ Nine temporary vaccination posts were set up on each island in the target communities; posts were open daily for at least eight hours and staffed with local health personnel and villagers.

A baseline survey, which was conducted six months before the mass vaccination campaign, examined social and cultural determinants of anticipated OCV acceptance.²⁵ Findings from that study showed that 93.5% of the interviewed adults intended to take a vaccine if offered without charge. However, when offered at three different prices levels—approximately USD 0.9, USD 4.5 and USD 9—acceptance rates dropped to 60.7%, 19.4% and 15.2%, respectively. Multivariable logistic regression models examining factors that affect vaccine acceptance if the OCV was offered at the three price levels showed that socio-cultural features of illness explain anticipated acceptance better than social epidemiological models containing mainly socio-demographic characteristics.

Since intention to receive a vaccine does not always predict vaccination,²⁶⁻²⁸ examination of how cultural concepts of cholera determine actual OCV acceptance (or uptake) is much-needed. Findings from such research may contribute essential information to increase

coverage of OCV in future mass vaccination campaigns for the benefit of cholera control in Zanzibar.

This study used the integrated methods framework of cultural epidemiology.²⁹ This research approach has been valuable in determining how local cultural concepts of illness (i.e., how people experience an illness, what causes they attribute it to and what they do for help seeking) affect health-related behavior.³⁰⁻³² The aim of this work was to identify social and cultural determinants of OCV uptake based on a random sample of adults that was interviewed before the 2009 mass vaccination campaign in Zanzibar.³³

Methods

Setting, study design and participants

Zanzibar belongs to the United Republic of Tanzania and consists of two major islands, Unguja and Pemba, just off the coast between Dar-Es-Salaam in the south and the Kenyan border in the north. Zanzibar has been regularly affected by cholera since the 1970s, and the government therefore recently decided to vaccinate major hotspots on both islands with assistance from the WHO. The peri-urban community of Chumbuni on Unguja island and the rural community of Mwambe on Pemba island—representing two out of the six cholera-endemic communities that had been identified as mass vaccination targets based on a review of recent epidemiological data—were chosen for this cross-sectional baseline survey.

Chumbuni is located at the outskirts of the capital Stonetown on the west coast of Unguja. It belongs to the Urban district and was inhabited by approximately 11,000 people at the time of the study in 2008,³³ relating to a population density of approximately 15,000/km². Mwambe is located on the southeastern tip of Pemba and belongs to Mkoani district. Approximately 8,000 people lived in 2008 in this rural village that is scattered in hamlets over a larger area than Chumbuni (population density: approximately 800/km²).

Interviews were done by trained field workers between June and August 2008, roughly half a year before the campaign was conducted in January and February 2009. Following a simple random sampling procedure, 180 houses were drawn per site. This sample size, which was obtained after adding 10% for potentially missing data, was based on the requirements for a cross-sectional study to allow comparisons of key variables between both sites with 95% significance and 80% power.³³ An equal number of men and women were approached at each village. The sampling frame came from existing geographic information system data (peri-urban site) and from a local census (rural site). Adult community members were selected through the sampled houses and asked for an interview if they were diarrhea-free, aged 18 years or older and fit for a discussion of about one hour duration. Three field teams per island, each comprising an interviewer and a note taker, completed on average two interviews per day. A more detailed description of both sites and more information on sampling has been presented elsewhere.³³

Instrument

Semi-structured interviews based on the Explanatory Model Interview Catalogue (EMIC) are the principal instrument of inquiry in cultural epidemiological research.³⁴ EMIC interviews allow empirical clarification of how locally valid features of illness-related experience, meaning and behavior are distributed in a population.³⁵⁻³⁷ Since adults who were apparently unaffected by cholera were the focus of this study, the EMIC interview began with the presentation of a clinical vignette that described a local person with cardinal somatic symptoms of cholera.³³ The interview also recorded socio-demographic characteristics and asked about anticipated acceptance of the OCV if it was offered without charge and at three different levels of cost.

Approach to analysis

Explanatory variables for analysis of determinants of OCV uptake were obtained from the baseline study.³³ These included socio-demographic characteristics and socio-cultural features of cholera-like illness, operationalized as patterns of distress referring to categories of somatic symptoms and social, emotional and financial impact, categories of perceived causes, self-treatment at home and help seeking outside households of affected persons. The outcome variable, respondents' vaccination status, was obtained from the mass vaccination database that had been compiled with the use of personal digital assistants by the International Vaccine Institute, Seoul.²⁴ Receipt of two complete doses of OCV was coded with a value of 1 (viz., fully immunized) and receipt of one or zero doses with a value of 0 (not immunized).

Determinants of uptake were identified in a staged process that involved uni- and multivariable logistic regressions in SAS 9.2 (SAS Institute, Cary, NC, USA). Crude analysis examined associations between OCV and explanatory variables that were reported by 5-95% of respondents. Only variables with $p < 0.2$ were retained for multivariable analyses to calculate 'focal' models for each subset of categories of socio-cultural features of illness (i.e., somatic symptoms, social impact, perceived causes and self-treatment at home). All focal models were adjusted for socio-demographic characteristics (e.g., gender, site, age, marital status etc.); the latter were also examined in a separate focal model. All variables identified in focal models with $p < 0.2$ were then used for calculating a 'comprehensive' model of social and cultural determinants of OCV uptake. Assessment of which focal model explained vaccine uptake better than the focal model containing only socio-demographic characteristics was based on the Akaike Information Criterion, corrected for sample size (AICc). The difference (Δ) of AICc between each model and the model with the lowest AICc was calculated; any focal model having a $\Delta(\text{AICc})$ noticeably lower than the model only containing socio-demographic characteristics was considered better. Interaction of rural or

peri-urban site with each variable was tested individually in focal models; interaction terms were only retained if their p values were below 0.1. Only interaction terms present in the focal models were assessed for inclusion in the comprehensive model based on the same threshold of $p < 0.1$. This approach to analysis followed exactly the one laid out in the study of anticipated OCV acceptance to ensure full technical comparability.²⁵

Anticipated acceptance if the OCV was offered without charge, and at low, medium and high price, respectively, were also considered as potential explanatory variables; however, only anticipated acceptance of a free OCV was included in an additional focal model because crude analysis showed no associations between intention to buy an OCV and uptake in the campaign ($p > 0.2$). Because 15.5% of the sample had reported a personal or household episode of cholera,²⁵ previous illness experience was also considered as potential explanatory variable, but not included in further analyses since crude analysis showed no suggestive association ($p = 0.44$).

This study was approved by the Research Ethics Review Committee of the World Health Organization and the Ethics Committee of the Ministry of Health of Zanzibar. All study participants gave written consent before being interviewed.

Results

Sample characteristics

A total of 356 interviews were completed, 179 in the peri-urban and 177 in the rural site. Slightly more than half of the study participants were women (50.3%). Mean age was 35.5 years, 76.4% were married and the mean household size was 6.8 persons. Major occupations were farming (30.6%), being housewife (21.4%) and working in the informal economy (17.1%). The sample consisted of Muslims, with the exception of one Christian woman. A

majority (55.9%) reported a regular and dependable household income. Further details of sample characteristics have been described elsewhere.³³

OCV uptake

Less than half of the respondents (49.7%) actually drank two doses of OCV, as documented in the mass vaccination database. More rural than peri-urban respondents drank the vaccine (58.8% vs. 40.8%, $p < 0.01$, Chi² test); and more women than men (54.8% vs. 44.6%), though with borderline statistical significance ($p = 0.056$, Chi² test).

Social and cultural determinants of OCV uptake

Crude analysis and focal models

Table 1 presents all variables that were identified in crude analysis together with focal models of socio-cultural features of illness (i.e., patterns of distress, perceived causes and self-treatment at home), of intention to receive the free OCV and of socio-demographic characteristics.

According to their $\Delta(\text{AICc})$ values, focal models of somatic symptoms and social impact and the model containing the ‘intention to receive the free OCV’ variable explained uptake better than the model containing only socio-demographic characteristics. Respondents who identified unconsciousness as a priority symptom and those among the rural respondents who strongly believed that cholera patients may cause a disruption in the local healthcare services were more likely to drink the OCV. Rural respondents and older respondents were also more likely to become vaccinated; and women tended to accept it more than men, though with borderline significance ($p = 0.053$). Nausea was the only negative determinant of OCV uptake identified in any focal model.

Comprehensive model

All socio-cultural features of illness identified as significant determinants of OCV uptake in the focal models (Table 1) were retained with similar effects in the comprehensive model that includes interactions with site (Table 2). An additional somatic symptom, loss of appetite, showed a negative association, but only in the rural site. Socio-demographic characteristics were also the same as in the focal model, with female gender clearly a significant positive determinant of OCV uptake ($p=0.03$). Anticipated acceptance for a free OCV appears to influence uptake; the adjusted regression coefficient is 0.91, but only marginally significant ($p=0.078$).

The overall effect of site (adjusted regression coefficient: 0.94, 95% confidence interval: 0.47 to 1.42, $p<0.01$) showed that rural respondents were more likely to accept the OCV (main effects model, not shown).

Comparing social and cultural determinants of anticipated acceptance and uptake of a free OCV

Because anticipated acceptance of a free OCV was almost 95%, a multivariable logistic regression of determinants of this outcome would be inappropriate. Nevertheless, to address the question of whether determinants of anticipated acceptance and of actual acceptance (i.e., uptake) are similar or different, univariable logistic regression was conducted to compare results for each outcome. Table 3 shows the variables that were associated in crude analysis ($p<0.05$) with respondents' willingness to receive a free OCV, including borderline results for gender and site. Similar to the crude analysis of uptake (Table 1), categories related to social impact, perceived causes, self-treatment at home and socio-demographic variables were identified as significant determinants.

Respondents who reported that cholera outbreaks may disrupt healthcare services were more likely both to have anticipated acceptance of the vaccine and to have actually taken it. Fear of infecting others, another cholera-related social concern, was also positively associated with anticipated acceptance but not uptake. Among perceived causes, only supernatural factors were identified as determinants of anticipated acceptance and uptake: respondents reporting God's will as a cause of cholera were less likely to anticipate vaccine acceptance, but respondents identifying witchcraft were more likely to actually drink the vaccine. Even though respondents who reported drinking more water or other liquids as a means of rehydration at home were more likely to anticipate acceptance, they were less likely to take the vaccine during the campaign.

Among socio-demographics, only two characteristics were identified as determinants in both analyses: gender and site. Although with borderline significance, women were more willing to accept the vaccine ($p=0.056$) and actually also drank it more often than men ($p=0.057$); residing at the rural site was a borderline negative determinant for anticipated acceptance ($p=0.056$), but a highly significant positive determinant for uptake ($p<0.01$). Reporting a regular and dependable household income was a positive determinant of anticipated vaccine acceptance, but this variable did not determine vaccine uptake. Increasing age, being married and being a farmer/fisherman were only positively associated with vaccine uptake.

Discussion

To improve the use of vaccines in endemic communities, public health planners need not only know coverage rates of vaccination campaigns, but also what social and cultural factors may have contributed to the achieved coverage.³⁸ By empirically examining the relationship between cultural concepts of illness and OCV uptake, a connection which has rarely been considered by classical epidemiologists and public health officials,³⁹ this study developed an

approach for contributing relevant information to help local decision makers to improve cholera control.

Pre-vaccination study results showed a high rate of anticipated acceptance (94%) across both islands. Despite this and the local organization and implementation of the 2009 mass vaccination campaign that attempted to minimize other access-related issues, uptake of the OCV was notably lower (50%). This uptake rate was between rates of two recent mass vaccination campaigns conducted in Africa and Asia. The 2003/2004 campaign using Dukoral® in an urban endemic neighborhood in the coastal town of Beira, Mozambique, estimated coverage of approximately 41% for people 15 years and older.⁸ Coverage with a locally produced two-dose OCV in a campaign conducted in 1998 in 13 communes of coastal Hue City, Vietnam, amounted to 74% for people aged 20 and above, and with significantly higher coverage among women.¹³

Socio-cultural features of cholera-like illness determined vaccine uptake better than if only social epidemiological factors were considered; this confirms the finding from the pre-vaccination survey and indicates the use of social and cultural study to examine anticipated and actual vaccine acceptance.

Demotivating factors for OCV uptake were related to symptoms of malaise: priority for getting a vaccine was reduced when people associated cholera with nausea and loss of appetite, which are not cholera-specific symptoms.

Higher OCV uptake in the rural site was further reinforced by the fact that concern about the detrimental impact of cholera outbreaks on local healthcare services was a positive determinant of uptake among rural respondents only. Rural villagers feared that the local

healthcare system would be overburdened with cholera cases; this might explain their preference for vaccination, although supplementary WASH activities were also frequently demanded.²⁵ This finding and the previously reported higher rural than peri-urban willingness to buy the OCV at a price of almost USD 10²⁵ suggest a higher priority for using OCV in rural Zanzibar.

Perceived severity of illness may influence desire for enteric vaccines.¹⁵⁻¹⁷ Because cholera was almost universally reported in both communities as “very serious” (97%) and “usually or sometimes fatal without treatment” (96%) (not shown), the influence of illness-related severity and fatality could not directly be analyzed as potential determinants of OCV uptake. Perceptions regarding severity and potential fatality were nevertheless related to vaccine acceptance in these communities because unconsciousness, a feature of dehydration and thus an advanced stage of cholera, was not only reported as one of the most prominent somatic problems,³³ but it was also identified as positive determinant of OCV uptake.

Increasing age and female gender were further positive determinants of OCV uptake. In contrast, Ali et al., who studied how socio-demographic and spatial variables influenced participation in a cholera vaccination trial in Kolkata, India, found that younger age was positively related.²² Although previous personal or household illness experience was not associated with OCV uptake, older people might have drunk the vaccine more often because of their higher likelihood to have witnessed the grave consequences of cholera. In line with the Kolkata study²² and the 1998 mass vaccination campaign in Vietnam,¹³ men were less likely to accept oral cholera vaccination. As in Zanzibar, it is not clear whether this reflects more responsibility or self-perceived vulnerability among women.

In addition to focusing on socio-cultural features of cholera, anticipated acceptance of the free

OCV was also assessed and found to be a tentative positive predictor of uptake. However, evidence that intention to receive a vaccine is directly related to vaccination behavior is still inconclusive;^{27,28,40} because of this and because no studies have yet firmly established such an association for cholera, further research is warranted to investigate this relationship.

Social and cultural determinants of anticipated acceptance and uptake of an OCV in a mass vaccination campaign in Zanzibar were not directly comparable because of almost universal willingness to accept free immunization. Recognizing this statistical limitation, comparison of crude associations nevertheless showed that categories related to social impact, perceived causes, self-treatment at home and socio-demographics are relevant determinants for both anticipated vaccine acceptance and actual behavior.

Although findings from this study were not available to guide planning for the campaign in Zanzibar, they may be relevant to guide future cholera mass vaccination action in the area. This study focused on adults in a cholera-endemic setting, but findings also indicate potential for such research in settings of epidemic cholera and to address the priorities of children.

Conclusion

Uptake of a free OCV in the 2009 mass vaccination campaign in a peri-urban and a rural endemic area of Zanzibar was lower than anticipated acceptance. This study showed that consideration of socio-demographic and economic factors is necessary but not sufficient to explain coverage, because socio-cultural features of cholera-like illness determined vaccine uptake better than purely social epidemiological models.

Social mobilization in future vaccination campaigns in Zanzibar to achieve the goal of elimination should benefit from findings presented here. Cholera as a cause of severe

dehydration should be emphasized vis-à-vis its moderate malaise-related symptoms. Rural recognition of the cholera-related burden on the local healthcare system was reflected by a priority for oral cholera vaccination; this shows not only the importance of vaccination for cholera control but also the need to strengthen healthcare services in Zanzibar, particularly in rural areas. Inasmuch as resources for public health are generally scarce in Zanzibar, findings indicate the importance to sensitize young adults, residents of peri-urban areas, and men to the value of the oral cholera vaccine for preventing cholera.

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Tables

Table 1 Crude analysis and focal models of social and cultural determinants of oral cholera vaccine uptake in a community mass vaccination campaign in Zanzibar, 2009, n=356

	Crude analysis ^a				Focal models ^b				Int ^f	$\Delta(\text{AICc})^g$
	Coeff. ^c	95% CI ^d	p value ^e		Coeff. ^c	95% CI ^d	p value ^e			
<i>Categories of distress: somatic symptoms</i>										0
Loss of appetite	-0.34	-0.70	0.02	0.07						
Loss of appetite (peri-urban site)					0.15	-0.33	0.62	0.54		
Loss of appetite (rural site)					-0.58	-1.22	0.06	0.08	*	
Nausea	-0.49	-0.99	0.02	0.06	-0.65	-1.22	-0.08	0.03		
Palpitations	-0.19	-0.44	0.06	0.14	-0.03	-0.31	0.24	0.81		
Unconsciousness	0.11	-0.05	0.27	0.18	0.21	0.04	0.38	0.02		
<i>Categories of distress: social impact</i>										3.06
Fear of isolation from others	-0.11	-0.27	0.05	0.18	-0.12	-0.29	0.05	0.16		
Disruption of healthcare services	0.36	0.01	0.70	0.04						
Disruption of healthcare services (peri-urban site)					-0.07	-0.53	0.38	0.75		
Disruption of healthcare services (rural site)					1.01	0.15	1.87	0.02	**	
<i>Perceived causes</i>										10.77
Unprotected/spoiled food	-0.15	-0.38	0.07	0.18	-0.02	-0.26	0.22	0.86		
Contact with contaminated water	0.19	-0.03	0.41	0.08	0.13	-0.11	0.37	0.28		
Witchcraft	0.50	0.08	0.91	0.02	0.26	-0.18	0.69	0.25		
Cannot say	0.35	-0.07	0.77	0.10	0.21	-0.24	0.66	0.36		
<i>Self-treatment at home</i>										5.83
Drinking more water or liquids	-0.16	-0.30	-0.01	0.04	-0.12	-0.28	0.03	0.12		
<i>Intention to receive OCV</i>										4.44
Anticipated acceptance of a free OCV	0.87	-0.05	1.78	0.06	0.91	-0.06	1.87	0.07		
<i>Socio-demographic characteristics^h</i>										6.05
Gender (male vs. female)	-0.41	-0.82	0.01	0.06	-0.48	-0.97	0.01	0.05		
Site (rural vs. peri-urban)	0.73	0.31	1.15	<0.01	0.73	0.15	1.31	0.01		
Age	0.02	0.00	0.03	0.01	0.02	0.01	0.04	0.01		
Marital status (married vs. not married)	0.68	0.18	1.19	<0.01	0.31	-0.25	0.88	0.27		
Main occupation (housewife/student/retired vs. farmer/fisherman)	-0.58	-1.07	-0.09	0.02ⁱ	-0.02	-0.70	0.66	0.96		
Main occupation (informal business/formally employed vs. farmer/fisherman)	-0.56	-1.09	-0.03	0.04ⁱ	-0.04	-0.70	0.61	0.90		

^aOnly variables with univariable association at p<0.2 listed;

^bEach model adjusted for socio-demographic characteristics, see footnote ^h;

^cLogistic regression coefficient;

^d95% Confidence interval;

^eFigures in bold if p<0.05;

^fInteraction of rural with peri-urban site (baseline) considered if p value of interaction term less than 0.1 (* p<0.1, ** p<0.05);

^gDifference of corrected Akaike Information Criterion (AICc) between each model and the 'best' model, designated with $\Delta(\text{AICc})=0$. Bold figures indicate models that explain vaccine acceptance better than the socio-demographic model only;

^hVariables used for adjusting. Figures reported in adjusted analysis refer to model with socio-

demographic characteristics alone;

ⁱVariable is nominal with 3 categories, overall $p=0.04$

Table 2 Comprehensive model of social and cultural determinants of oral cholera vaccine uptake in a community mass vaccination campaign in Zanzibar, 2009, n=356

	Comprehensive model ^a				Int ^e
	Coeff. ^b	95% CI ^c		p value ^d	
<i>Categories of distress: somatic symptoms</i>					
Loss of appetite (peri-urban site)	0.12	-0.36	0.59	0.63	
Loss of appetite (rural site)	-0.67	-1.34	-0.00	0.05	*
Nausea	-0.64	-1.21	-0.08	0.03	
Unconsciousness	0.19	0.02	0.37	0.03	
<i>Categories of distress: social impact</i>					
Fear of isolation from others	-0.08	-0.26	0.09	0.35	
Disruption of healthcare services (peri-urban site)	-0.06	-0.52	0.39	0.79	
Disruption of healthcare services (rural site)	0.91	0.00	1.81	0.05	*
<i>Self-treatment at home</i>					
Drinking more water or liquids	-0.13	-0.29	0.03	0.12	
<i>Intention to receive OCV</i>					
Anticipated acceptance of a free OCV	0.91	-0.10	1.92	0.08	
<i>Socio-demographic characteristics</i>					
Gender (male vs. female)	-0.51	-0.97	-0.05	0.03	
Site (rural vs. peri-urban)	0.83	-0.41	2.07	0.19	
Age	0.03	0.01	0.04	<0.01	

^aOnly variables identified in focal models at p<0.2 included in comprehensive adjusted model;

^bLogistic regression coefficient;

^c95% Confidence interval;

^dFigures in bold if p<0.05;

^eInteraction of rural with peri-urban site (baseline) considered if p value of interaction term less than 0.1 (* p<0.1)

Table 3 Crude analysis of social and cultural determinants of anticipated acceptance of a free oral cholera vaccine in Zanzibar, n=356

	Crude analysis ^a			
	Coeff. ^b	95% CI ^c		p value
<i>Categories of distress: social impact</i>				
Fear of infecting others	0.86	0.19	1.54	0.01
Disruption of healthcare services	0.89	0.06	1.72	0.04
<i>Perceived causes</i>				
God's will	-0.37	-0.64	-0.10	<0.01
<i>Self-treatment at home</i>				
Drinking more water or liquids	0.55	0.05	1.04	0.03
<i>Socio-demographic characteristics</i>				
Gender (male vs. female)	-0.89	-1.81	0.02	0.06
Site (rural vs. peri-urban)	-0.89	-1.81	0.02	0.06
Regular and dependable household income	1.14	0.22	2.05	0.02

^aOnly variables listed with univariable association with anticipated acceptance of a free OCV at p<0.05, except gender and site;

^bLogistic regression coefficient;

^c95% Confidence interval